RESPIRATION RATE OF GAMMA IRRADIATED CARNATION CUT FLOWERS

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ABSTRACT

The present paper presents the CO_2 production of the carnation cut flowers gamma-irradiated with a single dose of 750Gy. The cut flowers were soaked in preservative solutions, containing germicides or germicides plus 2% sucrose. The irradiation did not change the CO_2 production and did not cause any visible flower damage. The sucrose exogenous supply extended the vase-life of both irradiated and non-irradiated carnations. These results indicated that Nora carnation cut flower can be irradiated with 750Gy without commercial viability loss and that it is possible to use the radiation to disinfest this fresh product.

INTRODUCTION

Many European countries, as well as the USA and Japan have a very rigid phytosanitary inspection of imported fresh products to avoid the introduction of new plagues. The irradiation is a safe procedure that could be used instead of chemical treatments, which may be responsible for environmental contamination and can be dangerous for human health.

Cut flower consists of flower, stem and sometimes foliage. There are two stages in their physiology: first stage - flower bud growth and development of the plant to full opening, and second stage - maturation, senescence and wilting [1].

Respiratory metabolism of cut flowers comprises a rise to a maximum when flower starts to open, followed by a gradual decline during maturation and rising again, before the decline in the final stage of wilting [1] [2].

The holding solutions to extend the vase-life of the cut flowers are normally composed by germicides, sugar and other substances. Sucrose is one of the sugars that is included in preservative formulations [3] and prevents the detrimental effects of ionizing radiation on chrysanthemum cut flowers [4].

The ionizing radiation can stimulate the respiration in some plants [5]. On the other hand, exogenous sugar promotes respiration and extend the vase-life of cut flowers due to the maintenance of the pool of respirable substrate [6].

The present work aims to verify the respiration rate of carnation cut flowers after gamma irradiation and the resistance of flowers to disinfestating dose of 750Gy.

MATERIALS AND METHODS

Carnation cut flowers (*Dianthus caryophyllus*, cv. Nora) were obtained in a flower market, in Tsukuba. The stems were cut and soaked in tap water for 15 hours and were cut again to 20 cm length. The flowers were irradiated in a Gammacell 220, with a single dose of 750Gy (3kGy/hour), soaked in tap water.

After the irradiation the samples were distributed in the following way: Control - non-irradiated and soaked in a solution of 0.02% 8-hydroxyquinoline sulfate and germicides; I - irradiated and maintained in the same solution above; S - non-irradiated, soaked in the solution of 0.02% 8-hydroxyquinoline sulfate plus 2% sucrose, and; IS - irradiated and soaked in the solution containing sucrose.

The CO_2 production was determined in a Shimadzu GC-14B gas chromatograph equipped with a TCD (thermal conductivity detector) and a column of Porapak Q (2m), with helium as carrier gas and operated at 60°C. Respiration was measured by enclosing one flower for 6 hours in a flask of 1 liter of volume, maintained in a incubator Eyela LTI-600 SD (Tokyo Rikakikai Co., LTD), at 25°C, in the dark.

RESULTS AND DISCUSSION

Figure 1 shows the respiration rate of carnations cut flowers after the treatment with 750Gy of gamma radiation. Soon after the irradiation there was not meaningful differences between the irradiated flowers and the control ones. The CO_2 production decreased during the vase-life of the flowers in all samples, but from the third day the respiration rate of the sucrose exogenously supplied flowers was always higher than that of the flowers that did not receive the sugar. It happened independently from the irradiation. The differences between irradiated and non-irradiated carnations were not significant.

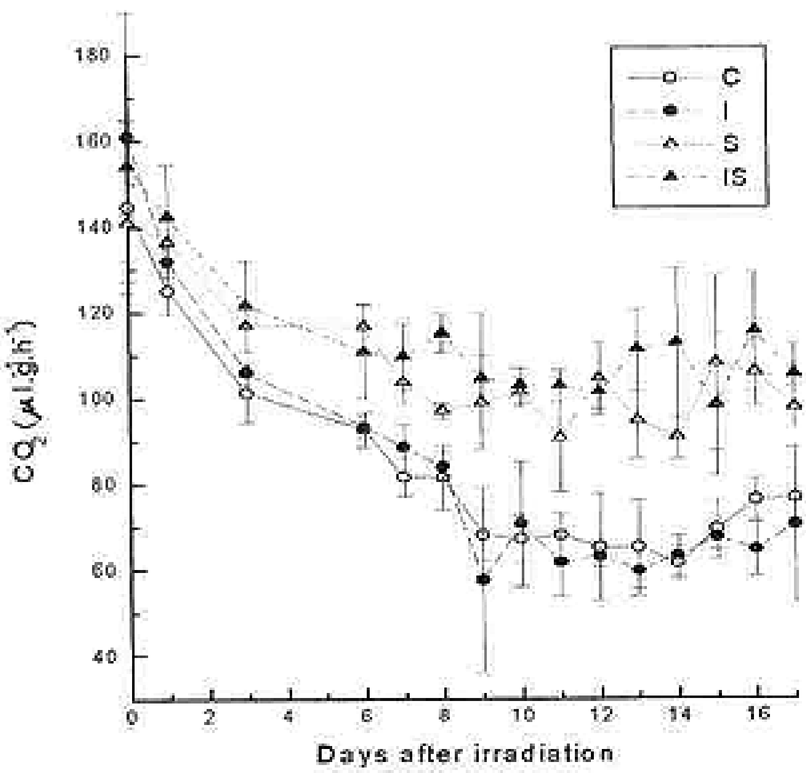

Figure 1. Respiration rate of carnation cut flowers, after gamma-irradiation with 750Gy. **C** - control; **I** - irradiated; S - non-irradiated, supplied with sucrose; **IS** - irradiated, supplied with sucrose.

Other varieties of carnations were resistant to gamma radiation [7] and to electron beam radiation [8] [9]. It did not mean that any modification happened when these flowers were irradiated. Depending on the dose, Tanabe and Kato [8] observed chlorosis and wilting on leaves and discoloration of the petals of carnation.

The sucrose uptake by carnation cut flower seemed to be controlled by membrane ATPase, which in turn was modulated by the fluidity of the surrounding lipids [2]. It is not known if the membrane fluidity is affected or not by 750Gy of gamma radiation, since at morphological and respiration level no modifications could be detected. The ethylene production did not change during the vase-life (data not shown), because of the post-harvest treatment of carnations with ethylene inhibitors. Probably, it was the cause of the absence of a second increase in the respiration rate, that is normal in the cut flowers physiology [1] [2].

The dose of 750Gy of gamma radiation inhibited the development of the flowers and extended the vase-life of the irradiated and sucrose supplied carnations (data not shown). In other varieties of flowers this inhibition conducted to an acceleration of the senescence process, decreasing the vase-life [10] [11] [7] [13]. The dose of 750Gy could be used for disinfestation purposes, without commercial viability loss of the fresh carnation cut flowers.

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